



Solar Thermal Power Plants

- the Offshore Wind Farms of the Desert

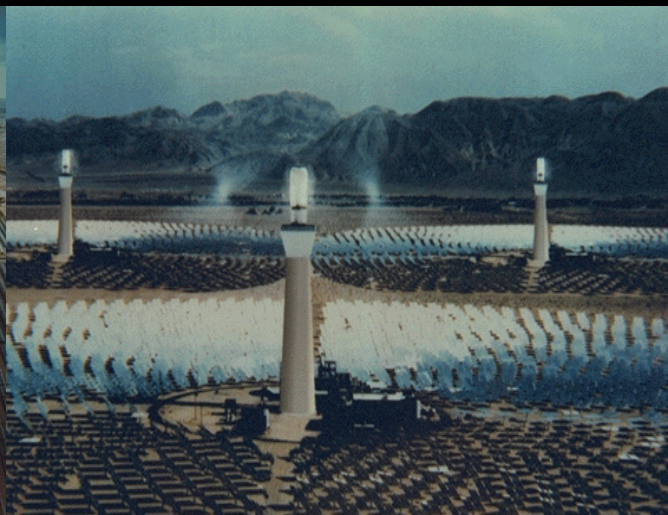
Exploiting the Power from the Sun to Combat Climate Change

World Renewable Energy Congress VIII

Plenary F2: Technology Solutions - Concentrating Solar Thermal Power

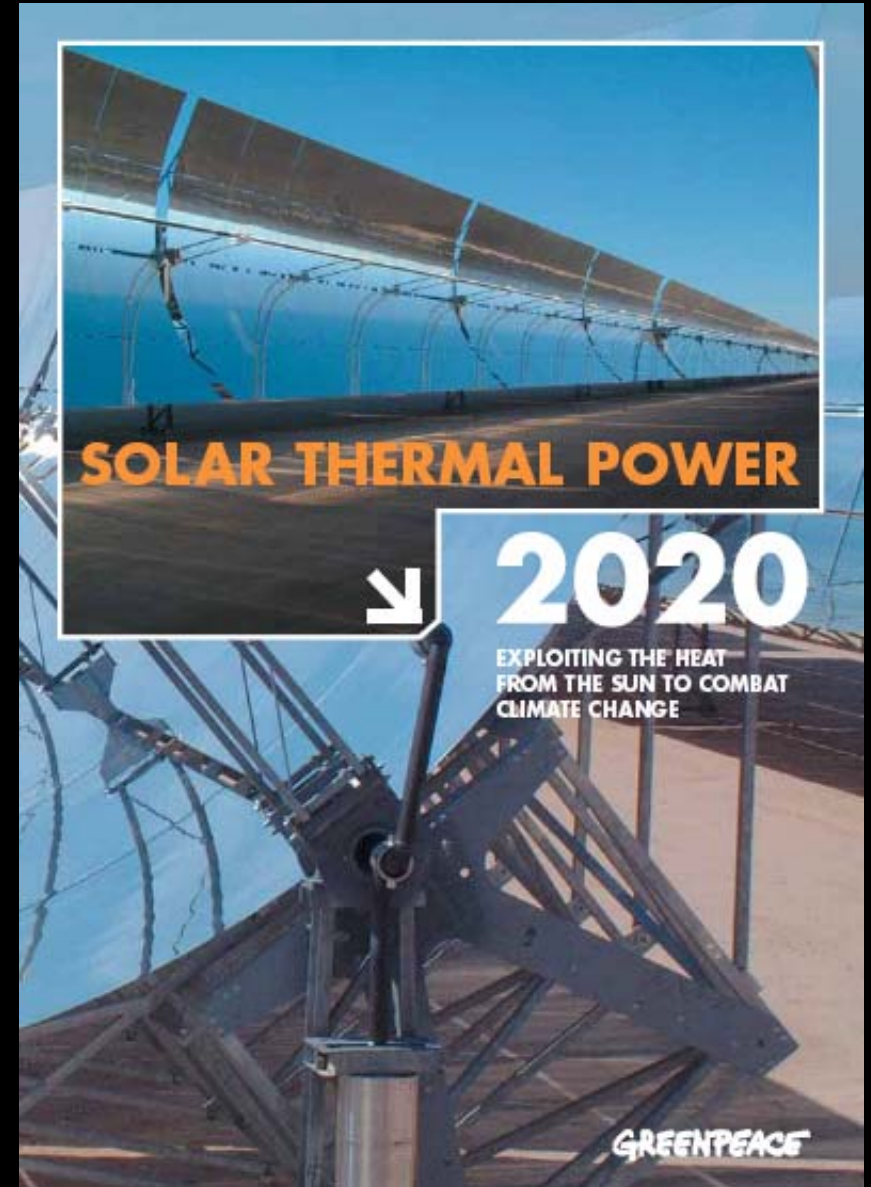
31 August, Denver, Colorado

Dr. Michael Geyer, Executive Secretary of the IEA SolarPACES Implementing Agreement





... credit for the title goes
to Greenpeace - ESTIA



latest report may be downloaded
from www.solarpaces.org



The Future for Solar Thermal Power

The Greenpeace – ESTIA Scenario for 2020

KEY RESULTS FROM GREENPEACE-ESTIA SCENARIO 2002-2020

Capacity of Solar Thermal Power in 2020	21,540 MW
Electricity Production in 2020	54.6 TWh
Cumulative Investment in Plant Construction	41.8 billion
Employment Generated	200,000 jobs
Carbon Emissions Avoided 2002 – 2020	154 million tonnes CO ₂
Carbon Emissions Avoided in 2020	32.7 million tonnes CO ₂
Projection 2021 to 2040	
Capacity of Solar Thermal Power in 2040	630,000 MW
Electricity Production in 2040	1573 TWh
Percentage of Global Demand	5%



Key Advantages of CSP?

- ★ Solar energy is the **most abundant sustainable** resource on Earth
- ★ The inherent advantage of STP technologies is their **unique integrability into conventional thermal plants**: All of them can be integrated as "a solar burner" in parallel to a fossil burner into conventional thermal cycles
- ★ With thermal storage or fossil fuel backup solar thermal plants can **provide firm capacity** without the need of separate backup power plants and without stochastic perturbations of the grid.
- ★ Solar thermal can supply **peak power in summerly heat periods** when hydro and wind are scarce
- ★ Solar thermal **creates jobs** in local Small and Medium Enterprises

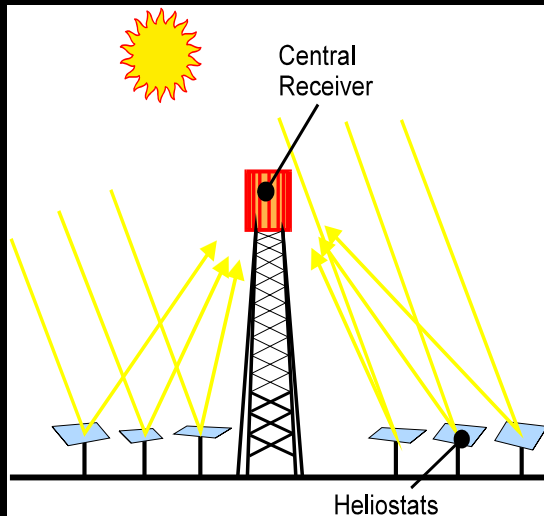


The **BUTS**

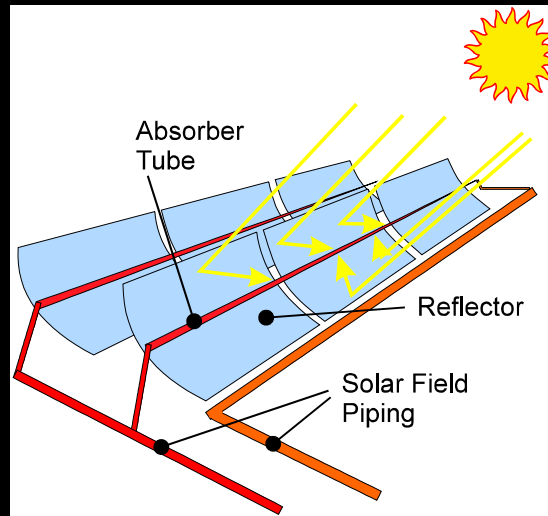
- ☹ CSP Technology is immature and does not work
- ☹ CSP Technology is too expensive
- ☹ No project was built after SEGS IX in California
- ☹ there is no industry willing to take the risk
- ☹ GEF projects in India, Egypt Morocco and Mexico are stalled



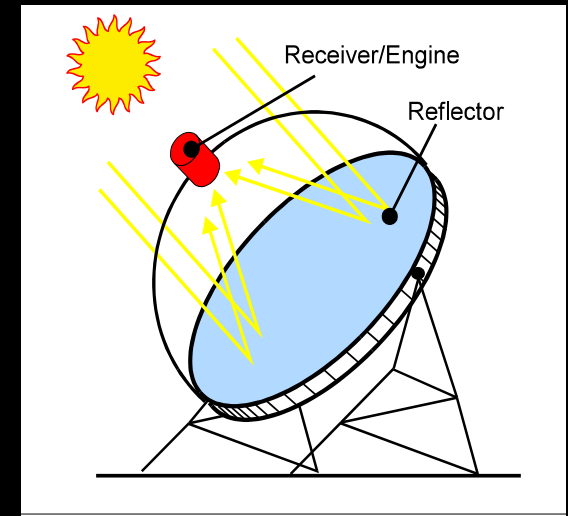
Maturity of CSP Technologies



Towers



Troughs



Dishes

SOLAR TOWERS

- **PROVED FEASIBILITY**
- **PROVED STORAGE**
- **CURRENT PROJECTS**
 - **PS10 of Abengoa in Spain**
 - **Solar Tres of SENER/Boeing**
 - **100MW Towers in SA by ESKOM**
 - **Receivers for GT and CC at PSA**



PARABOLIC DISHES

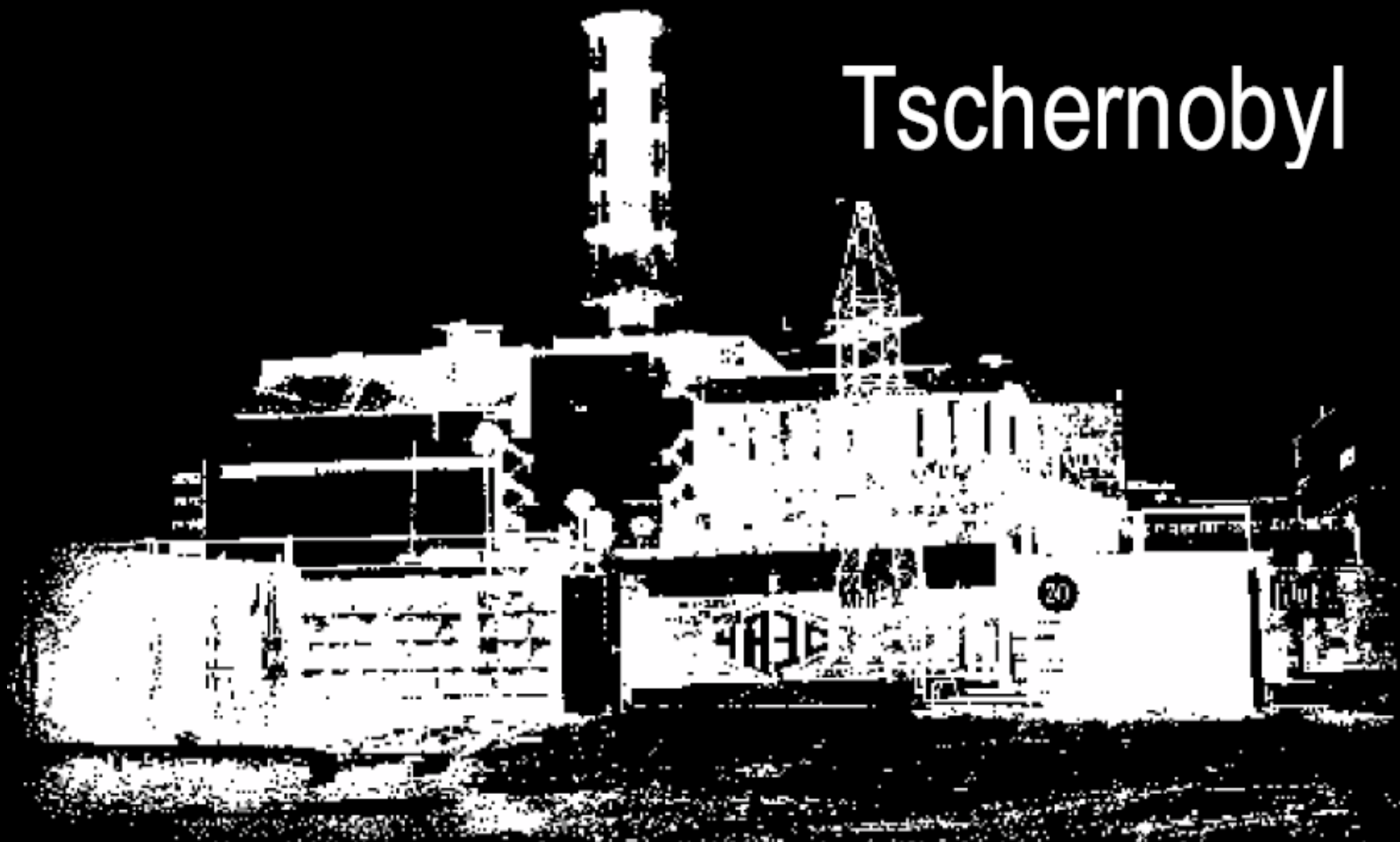
- PROVED HIGH EFFICIENCY
- MODULAR DESIGN
- REMOTE APPLICATIONS
- R&D OBJECTIVES
 - INCREASE AVAILABILITY
 - HYBRIDIZATION & STORAGE



1918 the curtain
fall over the further collector development



Tschernobyl





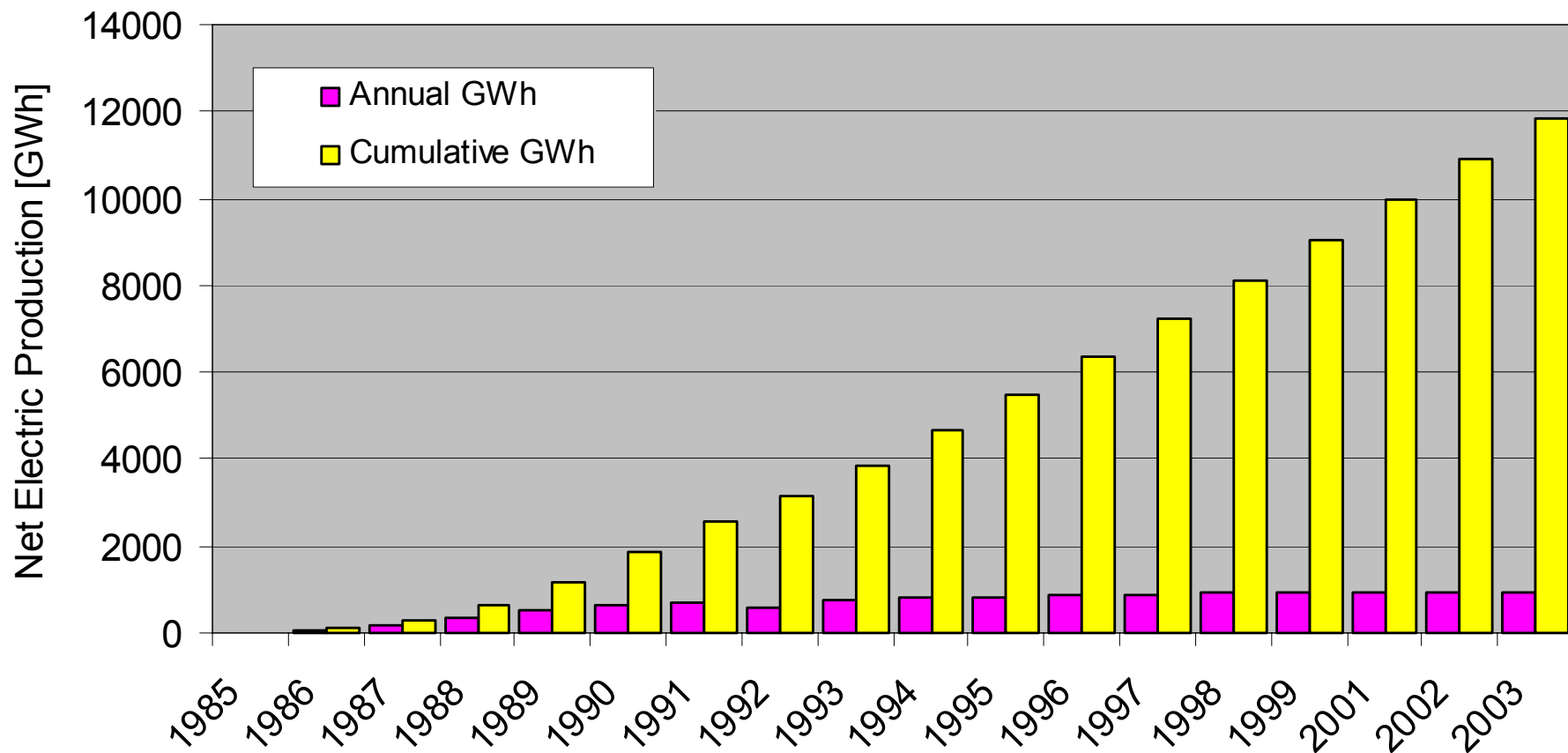
PARABOLIC TROUGHS

- **COMMERCIALLY MATURE**
- **MODULAR DESIGN**
- **354MW OPERATING**
- **OVER 10TWH GENERATED**
- **CHOICE OF MOST DEVELOPERS**



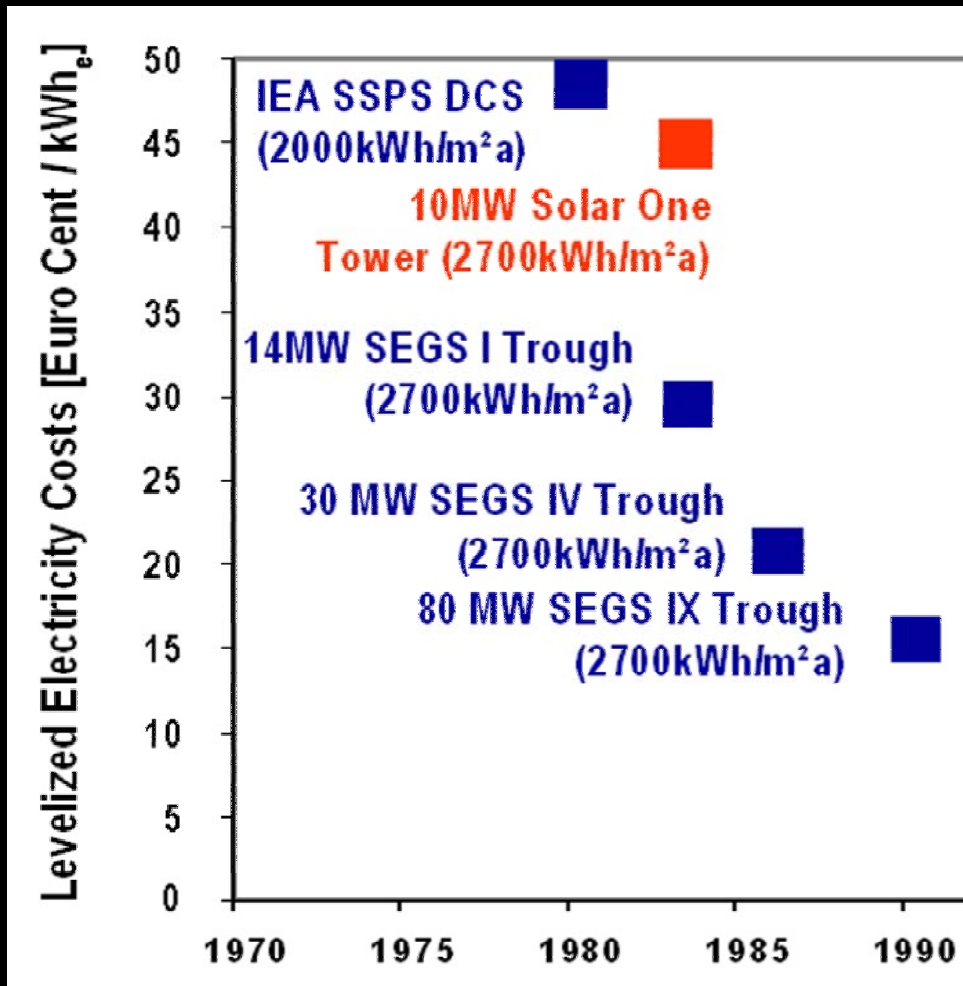


SEGS Plants have almost 20 years of performance records





... CSP Plants Too Expensive ?



Learning Curve 1970 - 1991

- While there have been substantial bankable incentive programs for Wind, PV and Biomass since 1998 there was no further bankable incentive programs for CSP until 2005
- The learning curve has been interrupted

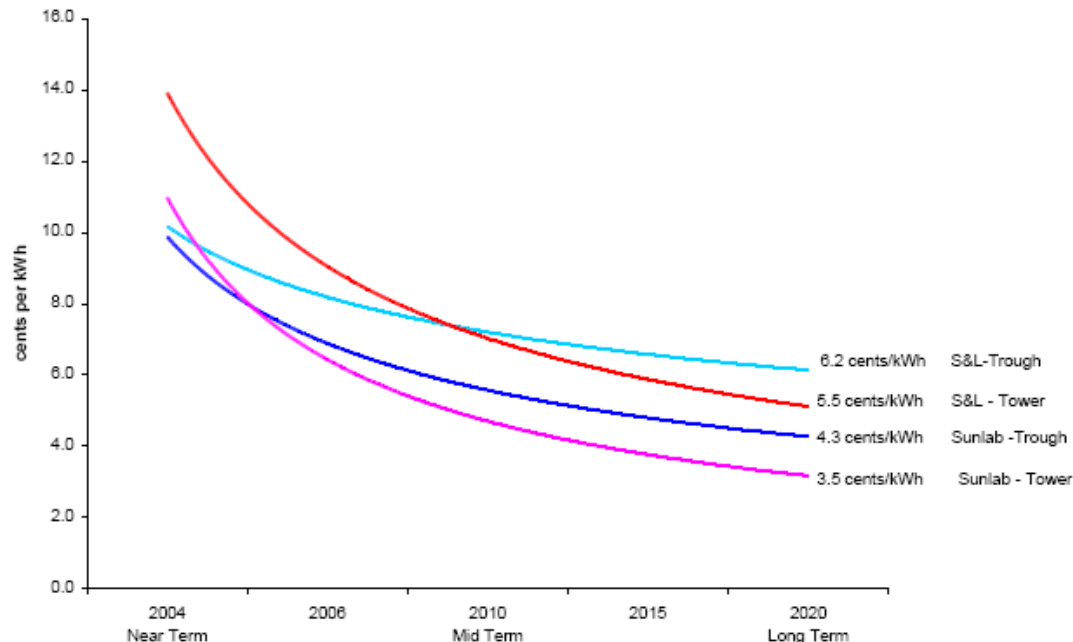


Future Cost Reduction Potential



ES-3
SL-5641
Final

Figure ES-1 — Levelized Energy Cost Summary



- **Hermann Scheer claimed it yesterday impossible to predict speed and time of cost reductions, sustainable mass implementation is the key to CSP competitiveness**
- **GMI targets at 5000MW until 2015**



The Problems of the GEF Projects

Apart from the complex administrative procedures between GEF and the host countries, the following CSP specifics accounted for the unsatisfactory delays in India, Egypt, Morocco and Mexico:

- **The Integration of CSP in Combined Cycles reduces transaction and incremental costs, but has never been demonstrated before.**
- **It would best work with storage, which also had never been demonstrated before.**
- **While the Combined Cycle suppliers are financially strong and used to take full multimillion guarantees for their part, the barely surviving CSP industries are too small to provide the same guarantees for the CSP part.**
- **Without markets in the developed world, the four isolated GEF projects were too insignificant to the big power players to even consider getting familiar with CSP and its risk**



How to Overcome this Situation ?

Need for

- **Convincing arguments for the local and national benefits of CSP – the environmental and climate protection arguments alone are not sufficient to convince governments for the need of CSP incentives**
- **Strong allies from outside the national power sector that will benefit from the implementation of CSP projects**
- **Technology demonstrations that will convince financiers and contractors of the risk acceptability**
- **Bankable CSP Power-Takeoff schemes: Cost covering and guaranteed over the payback period – i.e. 12 to 18 years**



The Arguments for CSP in Spain



- ✓ Longyear CSP technology development at the Plataforma Solar in Almeria



The Arguments for CSP in Spain



✓ Public cry for
summerly noon
peak power after
blackouts of the
heat wave in
2003



The Arguments for CSP in Spain



- ✓ Need for innovative investments and jobs in depressed economic areas
- ✓ The Incremental Cost of CSP don't leave the country but translate into local economic activity and jobs



The Arguments for CSP in Spain



New and powerful allies in the construction industry interested in new national projects that would followup the wind projects



New Spanish Feed-In Law for CSP: Real Decreto 436/2004

MINISTERIO DE ECONOMÍA

5562 *REAL DECRETO 436/2004, de 12 de marzo, por el que se establece la metodología para la actualización y sistematización del régimen jurídico y económico de la actividad de producción de energía eléctrica en régimen especial.*

2. Resto de instalaciones de energía fotovoltaica del subgrupo b.1.1:

Tarifa: 300 por ciento durante los primeros 25 años desde su puesta en marcha y 240 por ciento a partir de entonces.

Prima: 250 por ciento durante los primeros 25 años desde su puesta en marcha y 200 por ciento a partir de entonces.

Incentivo: 10 por ciento.

3. Instalaciones de energía solar térmica del subgrupo b.1.2:

Tarifa: 300 por ciento durante los primeros 25 años desde su puesta en marcha y 240 por ciento a partir de entonces.

Prima: 250 por ciento durante los primeros 25 años desde su puesta en marcha y 200 por ciento a partir de entonces.

Incentivo: 10 por ciento.

- Grants same tariffs for PV and CSP from 100kW to 50MW
- Cost covering with up to 0.21Euro/kWh
- Bankable with 25 year guarantee
- Annual adaptation to electricity price escalation
- 12-15% natural gas backup allowed to grant dispatchability and firm capacity
- After implementation of first 200MW tariff will be revised for subsequent plants to achieve cost reduction



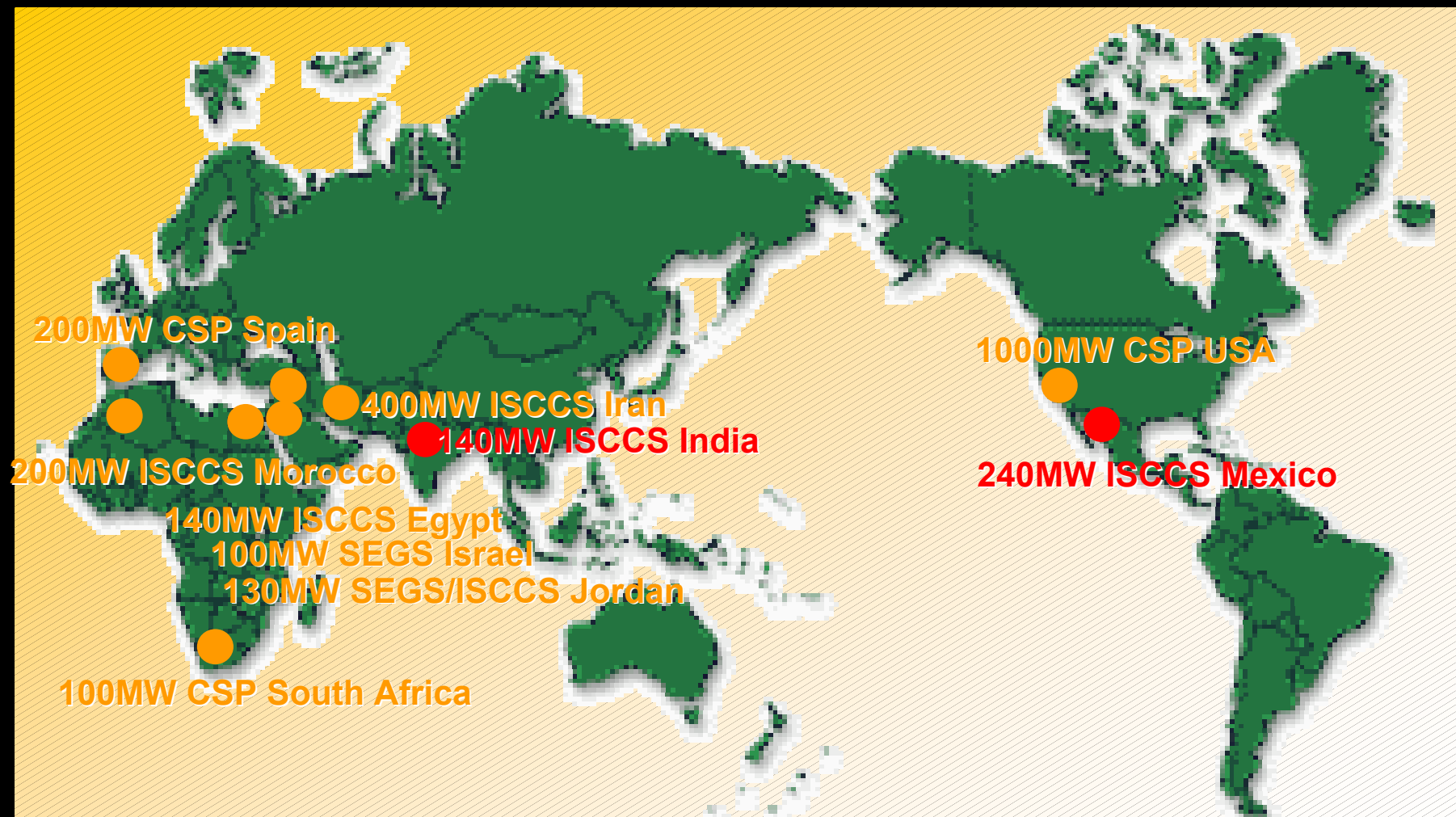
Project Developments under Royal Decree 436/2004



- ✓ Within 3 months after publication of RD436, half a dozen new CSP projects started development
- ✓ The new contractors are willing to take the risk of full EPC guarantees
- ✓ High interest of investors from utility sector to participate in equity
- ✓ Competition of commercial banks for financing
- ✓ New players ready to offer in GEF projects, since now they see a home market



International CSP Project Developments





Parabolic Troughs



Power Towers





If you want to learn more about CSP

... visit www.solarpaces.org

**... come to the 12th SolarPACES Symposium scheduled October 3-8, 2004
in Oaxaca, Mexico (see www.solarpaces.org)**

12th Solar PACES International Symposium



Solar Power and Chemical Energy Systems

